#508

PIONEER VENUS
ORBITER INFARED RADIOMETER
78-051A-16A

PIONEER VENUS 1

OIR RADIANCE DATA

78-051A-16A

This data set has been restored. There were originally two 9-track, 1600 BPI tapes written in Binary. There is one restored tape. The DR tape is a 3480 cartridge and the DS tape is 9-track, 6250 BPI. The original tapes were created on a 360 computer and the restored tapes were created on an IBM 9021 computer. The DR and DS numbers along with the corresponding D numbers are as follows:

DR#	DS#	D#	FILES	TIME SPAN
DR005049	DS005049	D043029	1 - 96	12/12/78 - 01/13/79
		D043030	97 - 180	01/18/79 - 02/14/79

REQ. AGENT	RAND NO.	ACQ. AGENT
BER	V0099	WSC

PIONEER VENUS

ORBITER INFARED RADIOMETER

78-051A-16A

This data set consists of 2 data tapes. These tapes are 1600 BPI, binary, 9 track, multi-filed and were created on a SEL 32/35 computer. Each orbit is contained in 3 files. The first file of each orbit contains the orbit number and days of orbit. The orbits per tape, time spans, 'D' and 'C' numbers follows:

D#	C#	ORBITS	TIME SPAN
D-43029	C-21736	4,6,7,9-12, 16-28,30-40	12/12/78 - 01/13/79
D-43030	C-21737	45-72	01/18/79 - 02/14/79

'78-051A-16A

Pioneer Venus Orbiter Infrared Radiometer

Experiment Description and Data User's Guide

for Information Submitted to the

National Space Science Data Center

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Experiment Description

The Pioneer Venus Orbiter Infrared Radiometer (OIR) was designed to study the meteorology of the middle atmosphere of Venus (60 - 130 km above the surface). The primary objectives of the experiment were to (1) measure vertical temperature profiles on a near-global scale, (2) map the morphology of the cloud tops, (3) search for atmospheric waves, (4) map the vertical and horizontal distribution of hazes, (5) measure the spatial distribution of water vapor, and (6) study Venus' energy balance.

The OIR instrument is a multichannel radiometer with a single two-inch reflecting telescope and an in-flight radiometric calibration capability. Three different optical subsystems were incorporated in order to obtain the broad spectral coverage and different spectral resolution requirements implied by the scientific objectives. These were:

(i) A pressure modulator radiometer or PMR (channel 1) to obtain three sub-channels covering all of the lines in the 15μm band with very high spectral resolution. The sub-channels were selected using a molecular sieve controlled by ground command to change the mean pressure of CO_2 gas in the modulator cell. Temperature measurements in the range 100 to 130 km, weighted differently with respect to height for each of three sieve modes, were obtained by this technique.

(ii) A fixed-grating Littrow spectrometer, to obtain three channels approximately 10 cm^{-1} wide on the wing of the 667 cm^{-1} (15μm) absorption band of CO_2 (channels 2-4) and one channel approximately 20 cm^{-1} wide in the atmospheric 'microwindow' near 11.5 μm (channel 5). These were used to obtain temperatures at various levels in the atmosphere at and above the cloud tops by measuring thermal emission in regions of different opacity.

(iii) A filter radiometer, employing transmission filters to isolate the spectral range 0.25 to 4.0 μm (Channel 7, for albedo measurements), a narrow interval 0.02μm wide centered on 2.0 μm (channel 6 for haze morphology measurements), and a broad interval 20 μm wide centered on 45 μm (channel 8, for humidity measurements).

All of the optics and the eight deuterated triglycine sulphate pyroelectric detectors were mounted in an optical bench, the interior of which was blackened and open only at the entrance aperture. The optical bench was thermostatically controlled at a temperature of 35°C to provide a stable radiative background. A reflecting shutter could be closed across the aperture on command from the ground, to provide a full-scale calibration. A zero radiance calibraton was obtained by viewing cold space during each 12 second revolution of the spacecraft. The field of view was 1.25° full angle (5° for the PMR), which corresponds to a nominal spatial resolution of 3 km on the cloud tops from a periapsis altitude of 150 km. Laboratory calibration, prior to flight, established the linearity and field of view characteristics of the radiometer and measured the wavelength response of each channel.

Since the instrument platform of the Pioneer Orbiter had no provision for pointing and the OIR had no internal scanning capability, the obtained coverage of the planet was entirely a function of the orbital geometry, the orientation of the spacecraft spin axis and the angle of view of the radiometer relative to the spin axis. The latter was selected to be 45°, in order to obtain the widest contiguous coverage of the Northern hemisphere with some useful redundancy in terms of multiple zenith angle views of a limited high-latitude region.

Vertical discrimination in the atmosphere was achieved by placing the temperature sounding channels in regions of different absorptivity of CO_2. The result is described by a set of weighting functions which describe the distribution in pressure (or altitude) of the sensitivity of each channel to emitted thermal radiation. Those appropriate to OIR are shown in Fig. 1. In general terms, the vertical resolution of the measurements may be taken as being equal to the half-width of the weighting function peaking at any particular level. Thus, channels 2, 3 and 4 (for example) measure the mean temperatures of approximately 10 km-thick layers centered on altitudes of roughly 90, 80 and 70 km respectively. An example is given in Fig. 1 of how the weighting functions depend on the local zenith angle (angle between instrument line of sight and local vertical at point observed). The effect is to move the peak of the weighting function to a lower pressure by an amount roughly proportional to $\mu^{\frac{1}{2}}$, where μ is the cosine of the local zenith angle. For the pressure modulator channels, the dependence on zenith angle is more complicated because the weighting function is multiply-peaked. It also depends on the line of sight velocity, because the PMR selects the line centers in the band which are comparable in width to the Doppler shift induced by relative velocities of a few km s^{-1}, typical of those encountered on this mission. An example of this effect is also shown if Fig. 1. The weighting functions for all of the temperature sounding channels must be known accurately in order to retrieve the atmospheric vertical temperature profile from one set of measurements (called a 'sounding'). The OIR weighting functions were measured in the laboratory using the flight instrument and multi-traversal White cell capable of giving optical paths of over 1 km amagat of CO_2.

Four different operating modes of OIR were possible. Mode 1 was global or mapping mode, in which 200 msec soundings (not necessarily contiguous) were loaded into memory whenever space for a complete sounding became available. This maximized the size of the area covered, allowing the available data rate to limit the number of soundings inside that area. Mode 2 was local or imaging mode, in which contiguous 30 msec soundings were made from acquisiton of the limb of the planet until the buffer memory was filled, whereupon the input to the buffer was inhibited until the start of the next roll of the spacecraft. This approach allows the available data rate to limit the area observed, but maximizes the resolution and coverage inside that area. Mode 3, limb mode, was automatically implemented whenever local mode was also in use. This involved halving the dwell time during the period that the field of view was sweeping across the limb of the planet, thus giving overlapping samples of the atmospheric limb radiance profile. Note that in modes 2 and 3, no channel 1 data are acquired. Mode 4 was calibration mode, in which the shutter was closed for four soundings and then reopened so that four soundings of cold space could be obtained.

A complete global mode circuit of the planet produced about 4000 soundings of Venus and a complete local / limb mode orbit about 40,000. Soundings consist of an 8 bit data number (DN) for each channel (i.e., in the range 0-255). Because of storage limitations, the instrument toggled back and forth between channels 7 and 8, such that data in these two channels were obtained on alternating rolls of the spacecraft.

The calibration shutter was latched shut over the instrument aperture during cruise and orbital insertion and so the first in-flight check of instrument performance was made during orbit 1 following release of the catch retaining the shutter. A series of measurements of cold space was made in order to determine the signal to noise ratio in each channel. Only one discrepancy was noted: the channel 8 detector had suffered a loss of responsivity, so that its full-scale signal had fallen from about 180 to about 140 DN. Later, the channel 8 gain was noted to be wandering with a total amplitude of around 10 DN. Both effects are probably the result of physical damage to the detector element, perhaps during launch. Neither renders the channel 8 data useless, but they do complicate the analysis. A summary of the characteristics of each channel is given in Table 1.

A power supply problem which manifested itself briefly during orbit 2, and twice more (orbits 9 and 53), became permanent after orbit 72. The symptoms were a drop in the regulated $\pm$ 10 volt supply to around $\pm$ 6.5 volts, with a consequent loss of all the critical instrument functions. Resetting the instrument with a pair of off/on commands cured the problem the first three times, with no loss of data since Venus was not being observed at the time. Except when it was actually in the failed condition, there was no evidence of any degradation in performance right up to the end of the orbit 72 periapsis pass. The problem has been ascribed to contamination of the large-scale hybrid module containing the power supply circuitry.

The reduced data, described below, are presented with respect to three coordinate systems, Aries/ecliptic, solar-fixed, and Venus body-fixed.

In the first system, the terrestrial vernal equinox, which points to the constellation Aries, serves as zero longitude. The z-axis is defined by the ecliptic North pole, that is, the normal to the plane of the Earth's orbit. Although this coordinate system is defined by terrestrial standards, its origin is displaced to coincide with the center of Venus.

The solar-fixed coordinated system takes its zero latitude and longitude as the sub-solar point. The z-axis is perpendicular to the "illumination equator", and thus is parallel to Venus' orbital pole. The Aries/ecliptic latitude and longitude of the normal are $86\overset{\circ}{.}61$ and $346\overset{\circ}{.}23$, respectively.

The third system, Venus body-fixed, co-rotates with the solid body of the planet with a period of 243 days. The x-axis is defined by the I.A.U. such that 320° longitude was on the central meridian as seen from Earth at 0^{h}UT on 20 June 1964. The pole of rotation is an estimate determined from radar measurements and was adopted by the Pioneer Venus Science Steering Group to have the Aries/ecliptic latitude and longitude of $88\overset{\circ}{.}51$ and $31\overset{\circ}{.}48$, respectively.

The operation of the OIR instrument covers the period from 5 December 1978 to 14 February 1979. Because of processing problems with some orbits, data are provided for the following 60 orbits: 4, 6, 7, 9-12, 16-28, 30-40, 45-72.

Data Reduction

The OIR team produces reduced data by first generating a Science Data Tape (SDT), which contains time and geometry tagged raw OIR data. From this, a Radiance Data Tape (RDT) is produced in which the data are calibrated and sorted according to viewing geometry. The data provided to NSSDC comprise RDT's. One RDT is generated for each orbit.

The data values for each channel are stored in file 3 of the RDT as 8-bit data numbers, which are linearly proportional to radiance, or in the case of channels 6 and 7, reflectivity. The absolute calibrations in channels 6 and 7 are quite uncertain, and only relative reflectivity variations should be used, unless an external means of absolute calibration is supplied by the user. Radiances in the thermal channels are given in units of watts/cm^2/wave number/steradian.

For the purposes of making images from the data in which shading due to viewing (and solar zenith) angle is removed, least-square fits in μ (the cosine of the local viewing angle), and in the case of channels 6 and 7, μ_o (the cosine of the local solar zenith angle) have been made. Two methods, polynomial and power law, have been used.

Thermal channel shading (limb-darkening) functions:

Polynomial $$B(\mu) = C_1 \{1+\sum_{n=1}^{5} C_{n+1} (\mu^n - 1)\}$$

Power law $$B(\mu) = C_1 \mu^{C_2}$$

Reflectance channel shading functions:

Polynomial $$B(\mu, \mu_o) = \mu_o C_1 \{1+C_2(\mu+\mu_o-2) + C_3 (\mu \mu_o -1) + C_4 (\mu^2+\mu_o^2-2) + C_5 (\mu^2\mu_o+\mu_o^2 \mu-2) + C_6 (\mu^2\mu_o^2-1)\}$$

Power law $$B(\mu, \mu_o) = \mu_o C_1 (\mu \mu_o)^{C_2}$$

The coefficients C_k are stored in file 2 of the RDT. The shading corrected DN in file 3 represents estimates of what DN would be observed if $\mu = \mu_o = 1$, via the relation:

$$\text{shading corrected radiance} = \left(\frac{\text{measured radiance}}{\text{model radiance}}\right) \times \text{model radiance at } \mu=\mu_o=1.$$

DN in file 3 are converted to radiance (or reflectivity) by:

$$R = \text{ACAL} \times \text{DN} + \text{BCAL}$$

Where ACAL and BCAL for each channel are given in file 2 of the RDT. Because a shading corrected radiance may correspond to a DN >255, which is out of range of 8-bits, in such cases the shading corrected DN are scaled down so that the maximum DN is 255. When this happens, the ACAL value must be scaled as well, although BCAL is unchanged. For this reason, the ACAL values for both the polynomial shading corrected and power law shading corrected radiances are given in file 2. Other parameters describing the model fits, such as polynomial order, number of data points used, and root-mean-square residuals, are given in file 2.

Caution: for analyses in which precise viewing angle geometry must be known, μ and μ_o values for data with $\mu < .5$ should be regarded as very uncertain.

OIR Radiance Data Tape Description

1600 bpi, 9-track

The data for each orbit are contained in 3 files, each terminating in an end-of-file (EOF) mark. The records are written with no FORTRAN format control information as part of the recorded data.

FILE 1. Header file

Contains 15 integer words in 1 physical record.

1. Orbit No.
2. Year } of orbit periapsis
3. Month } of orbit periapsis
4. Day } of orbit periapsis
5. Data start time in Spacecraft Universal Time (SCUT) (msec)
6. Data stop time in SCUT (msec)
7. Periapsis time in SCUT (msec)
8. Version number of SDT used to produce this RDT
9. Year } of precursor SDT generation
10. Month } of precursor SDT generation
11. Day } of precursor SDT generation
12. Version number of this RDT
13. Year } of generation of this RDT
14. Month } of generation of this RDT
15. Day } of generation of this RDT

EOF

notes: (1) SCUT is Universal Time of spacecraft event, converted to milliseconds (e.g., $00^h00^m = 0$; $24^h00^m = 86400000$)

FILE 2. Geometry and calibration file

Contains 155 single precision floating point words in 1 physical record.

1. Sub-spacecraft latitude
2. Sub-spacecraft longitude
3. Sub-solar latitude
4. Sub-solar longitude
5. Sub-Earth latitude
6. Sub-Earth longitude

(1–6: At periapsis Aries/ecliptic coordinates, Venus centered)

7-12. Same as 1-6 in Venus body-fixed coordinates
13-14. Same as 1-2 in solar-fixed coordinates
15-16. Same as 5-6 in solar-fixed coordinates
17. Latitude of Venus orbit pole
18. Longitude of Venus orbit pole
19. Latitude of Venus rotation pole
20. Longitude of Venus rotation pole
21. Latitude of Venus body-fixed x-axis
22. Longitude of Venus body-fixed x-axis

(17–22: Aries/ecliptic coordinates)

23-30. Radiance/DN multiplicative conversion factors, ACAL, channels 1-8
31-38. Radiance/DN additive conversion factors, BCAL, channels 1-8
39-46. Polynomial shading corrected radiance/DN multiplicative conversion factors, ACAL', channels 1-8
47-54. Power law shading corrected radiance/DN multiplicative conversion factors, ACAL", channels 1-8
55-102. Polynomial coefficients, C_k (6 each channel), channels 1-8
103. Order of polynomials, thermal channels
104. Order of polynomials, reflective channels
105-120. Power law coefficients, C_k (2 each channel), channels 1-8
121-128. Number of data points used in polynomial fits, channels 1-8
129-136. Number of data points used in power law fits, channels 1-8
137-144. RMS residuals, polynomial fits, channels 1-8
145-152. RMS residuals, power law fits, channels 1-8
153. Minimum μ allowed in shading function fits
154. Minimum μ_o allowed in reflective shading function fits
155. PMR sieve mode (0 = low; 1 = medium; 2 = high)

EOF

FILE 3 Sounding file

Contains 150 record groups (bins), each bin consisting of a header record and multiple data records with integer words.

Each sounding is described by 17 words. Up to 2040 words or 120 soundings are contained in a physical data record. The number of data records in each bin required to write N_s soundings for that bin = N_r = INT $\left[(N_s - 1) / 2040\right] + 1$.

2040 words will be found in each physical data record except for the last one in the bin, which will contain $17 \times \left[N_s - (N_r - 1) \times 120\right]$ words. The 150 bins are 1^o wide latitude bins containing data from 90^oN to 60^oS. The first bin corresponds to data with viewed latitude between $89^o.01$ and 90^oN latitude (Aries/ecliptic); the second to data between $88^o.01$ and 89^o, and so on. The 149th bin contains data between $-58^o.99$ and -58^o, and the 150th contains data between -60^o and -59^o. Due to orbital geometry, no data are obtained at high southern latitudes.

Header record - 4 integer words in 1 physical record

1. Number of soundings, N_s, in this bin (may be zero, in which case the number of data records for this bin, N_r, is zero).
2. Upper limit latitude of this bin (degrees) x 10^2
3. Minimum longitude in this bin (degrees) x 10^2
4. Maximum longitude in this bin (degrees) x 10^2

Aries/ecliptic

Data records consist of the following sequence of 17 integer words (one sounding) repeated up to 120 times per data record:

1. DN, channels 1-4 (each 8-bits) (channel 1 corresponds to most significant byte)
2. DN, channels 5-8 (each 8-bits) (channel 5 corresponds to most significant byte)
3. Polynomial corrected DN, channels 1-4 (each 8-bits)
4. Polynomial corrected DN, channels 5-8 (each 8-bits)
5. Power law corrected DN, channels 1-4 (each 8-bits)
6. Power law corrected DN, channels 5-8 (each 8-bits)
7. VLAT (degrees) x 10^2; VLON (degrees) x 10^2 (each 16-bits) (VLAT corresponds to most significant half word) [Aries/ecliptic]
8. VLAT (degrees) x 10^2; VLON (degrees) x 10^2 (each 16-bits) [Venus body-fixed]
9. VLAT (degrees) x 10^2; VLON (degrees)x 10^2 (each 16-bits) [Solar-fixed]
10. $\mu \times 10^4$; $\mu_o \times 10^4$ (each 16-bits) (μ corresponding to most significant halfword)
11. $\cos(\phi-\phi_o) \times 10^4$; footprint θ (degrees) x 10^2 (each 16-bits) ($\cos(\phi - \phi_o)$ corresponds to most significant halfword)
12. SMEARA (*km*); SMEARB (*km*) (each 16-bits) (SMEARA corresponds to most significant halfword)
13. VLKLAT (degrees) x 10^2; VLKLON (degrees) x 10^2 (each 16-bits) (VLKLAT corresponds to most significant halfword)
14. Venus surface to viewed point distance (*km*) x 10^3
15. Line-of-sight velocity of spacecraft (*km/sec*) x 10^3
16. Time of sounding (msec relative to periapsis)
17. DQI

⋮

The record structure of the sounding file is therefore as follows:

$$\left.\begin{array}{l}\text{Header record}\\ \text{Multiple data records}\end{array}\right\}\quad\text{repeats 150 times}$$

EOF

notes:

(1) In each bin, soundings are presented in order of increasing Aries/ecliptic viewed longitude.

(2) All longitudes in the data record which are stored as 16-bit halfwords must be added to 180^o to get the correct numberical value. This is so the numbers could be stored as 16-bits.

(3) VLAT, VLON are the latitude and longitude of the viewed point.

(4) VLKLAT, VLKLON are the Aries/ecliptic latitude and longitude of the radiometer look vector.

(5) μ = cosine of angle between local normal and direction to spacecraft

μ_o = cosine of angle between local normal and direction to sun.

$\cos(\phi - \phi_o)$ = cosine of the azimuth difference in the plane of the local horizontal between vector pointing to the spacecraft and vector pointing to the Sun.

(6) All geometry on Venus is referenced to a surface lying 60 km above the Venus surface. The radius of Venus is taken as 6050 km, so the reference altitude is taken to be 6110 km from the center of the planet.

(7) The footprint (area subtended on Venus by a sounding) is modelled as an ellipse and described by 3 parameters: SMEARA, SMEARB, AND θ.

$$\left.\begin{array}{l}\text{SMEARA} = \text{major axis of ellipse} \\ \text{SMEARB} = \text{minor axis of ellipse}\end{array}\right\} \text{for } 1.^{\circ}25 \text{ field-of-view}$$

For all soundings which lie on the planet ($\mu \neq 0$, Venus surface to viewed point distance = 60 km), θ is the angle between the footprint major axis and a vector parallel to a line of constant latitude on Venus pointing in the direction of increasing longitude. For soundings in which any part of the footprint lies off the reference surface, μ is set to 0 and the viewed point is taken to be the tangent point of the radiometer look vector relative to Venus. In these cases θ is the angle between the footprint major axis and a vector parallel to the local horizontal pointing counterclockwise around Venus as seen from the spacecraft.

(8) DQI = data quality indicator.

This is an eight digit number. The right-most digit corresponds to channel 1, the next-to-the-right-most digit to channel 2, and so on. An indicator of 0 for a channel indicates missing data. An indicator of 1, 2, or 3 indicates various degrees of confidence in receipt of the data, with 3 the best.

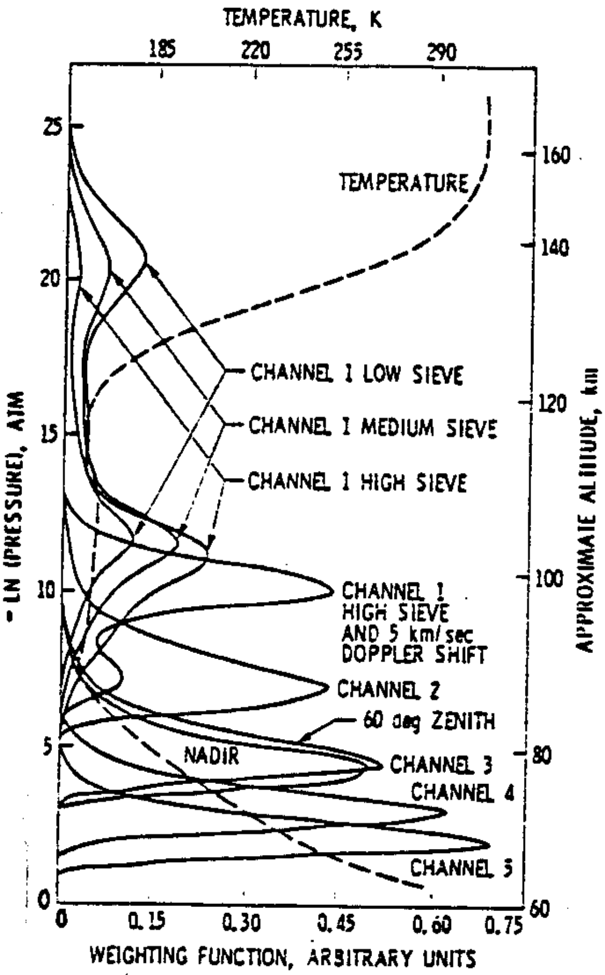
(9) Integer words and single precision floating point words are 32-bits. Halfwords are 16-bits and bytes are 8-bits. Integer words (in the sounding file) which are composed of 2 halfwords or 4 bytes of data may be decomposed into the appropriate values by defining an "equivalence" between a 2-element halfword array or 4-element byte array and the word in question.

(10) The sign of integer halfwords, integer words, and single precision floating point words is stored in the most significant bit, where 0 represents + and 1 represents - . Negative numbers are carried in twos complement form. Bytes are unsigned.

TABLE 1

CHANNEL	SPECTRAL BAND	OPACITY SOURCE	MAIN FUNCTION	RADIOMETRIC UNCERTAINTY ABSOLUTE	RADIOMETRIC UNCERTAINTY RELATIVE
1. Low sieve PMR*	600–750 cm^{-1}	CO_2	Temperature 100–130 km	20%	4%
Medium sieve PMR*	600–750 cm^{-1}	CO_2		9%	3%
High sieve PMR*	600–750 cm^{-1}	CO_2		5%	2%
2. Grating	676–686 cm^{-1}	CO_2	Temperature near 90 km	< 1%	< 1%
3. Grating	722–736 cm^{-1}	CO_2	Temperature near 80 km	< 1%	< 1%
4. Grating	757–771 cm^{-1}	CO_2,cloud	Temperature near 70 km	< 1%	< 1%
5. Grating	861–883 cm^{-1}	cloud	Cloud top temperature	< 1%	< 1%
6. Transmission Filter	4845–5015 cm^{-1}	cloud,CO_2	High clouds and haze	---	3%
7. Transmission Filter	2000–50,000 cm^{-1}	cloud, CO_2 H_2O	Albedo	---	< 1%
8. Reflection Filter	182–286 cm^{-1}	cloud, H_2O	Energy budget, humidity	3%	2%

*PMR low sieve pressure = 2.05 mbar
medium sieve pressure = 3.97 mbar
high sieve pressure = 9.34 mbar



TEMPERATURE, K
185
220
255
290
TEMPERATURE
CHANNEL 1 LOW SIEVE
CHANNEL 1 MEDIUM SIEVE
CHANNEL 1 HIGH SIEVE
CHANNEL 1
HIGH SIEVE
AND 5 km/sec
DOPPLER SHIFT
CHANNEL 2
60 deg ZENITH
NADIR
CHANNEL 3
CHANNEL 4
CHANNEL 5
- LN (PRESSURE), ATM
25
20
15
10
5
0
APPROXIMATE ALTITUDE, km
160
140
120
100
80
60
0
0.15
0.30
0.45
0.60
0.75
WEIGHTING FUNCTION, ARBITRARY UNITS

Figure 1

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RECORD 1 OF FILE 1
LENGTH = 60 BYTES

ORBIT	YEAR 78	month 12	Day 12						
00000004	0000004E	0000000C	0000000C	FFBD461D	0006DB27	0325EDB3	00000005	0000004F	00000003
00000001	00000001	0000004F	00000003	00000007					

1 RECORD IN FILE 1 OF TAPE

```
RECORD       1  OF FILE  97
LENGTH =      60  BYTES

0000002D  0000004F  00000001  00000012  FFBBBB8C  000FB93D  042B7F74  00000001  0000004F  00000004
0000001E  00000001  0000004F  00000006  0000000B

1 RECORD IN FILE  97 OF TAPE
```

```
                                    DUMP OF TAPE BR290UTA

  INPUT TAPE    BR290UTAON   MT4
  DATA INPUT      H9 NF 94 FL 1 1 1 SR 94 1 1 SR 94 LAST 1

   FILE       1  RECORD         1  LENGTH        60BYTES
   (      0)    00000004   0000004E   0000000C   0000000C   FFED461D   0006DB27   0325EDB3   00000005   0000004F   00000003
   (     40)    00000001   00000001   0000004F   00000003   00000007

          FILE    INPUT     DATA RECORDS      MAX.          READ ERROR SUMMARY              INPUT RETRIES
                  RECS.        INPUT          SIZE       PERM   ZERO B    SHORT   UNDEF.   #RECS.   TOTAL#
             1       1           1             60          0       0        0        0        0        0

   FILE      94  RECORD         1  LENGTH        60BYTES
   (      0)    00000028   0000004F   00000001   0000000D   00001F01   00164D87   04189A3F   00000001   0000004F   00000003
   (     40)    00000016   00000001   0000004F   00000003   0000001B

          FILE    INPUT     DATA RECORDS      MAX.          READ ERROR SUMMARY              INPUT RETRIES
                  RECS.        INPUT          SIZE       PERM   ZERO B    SHORT   UNDEF.   #RECS.   TOTAL#
            94       1           1             60          0       0        0        0        0        0
 ******       EOF ON COMPLETION OF DUMP FOR REQUEST SR=94=1=1X
 ******       EOF ON COMPLETION OF DUMP FOR REQUEST SR=94=1=1X

  EOJ         DUMP STOPPED AFTER FILE    94         # OF PERMANENT READ ERRORS  0

 START TIME 10/13/81   11:39:23         STOP TIME 10/13/81  11:43:19


 $$
 $ASS IN MT3
 $EXE TPDUMP 3S
```

Pioneer Venus
D-43029
Orbits 4, 6, 7, 9-12,
16-28, 30-40
96 files

ORBIT YR MM DD

Pioneer Venus
78-051A-16A
D-43030
1/18/79-2/14/79
orbits: 45-72
84 files

```
                              DUMP OF TAPE BR-300UT

   INPUT TAPE   BR-300UTON   MT4
   DATA INPUT     H9 NF 84  SR 1 1 1  SR 82 1 1

    FILE      1  RECORD      1  LENGTH      60BYTES
    (      0)  0000002D  0000004F  00000001  00000012  FFBBBB8C  000FB930  042B7F74  00000001  0000004F  00000004
    (     40)  0000001E  00000001  0000004F  00000006  0000000B

          FILE   INPUT    DATA RECORDS    MAX.        READ ERROR SUMMARY              INPUT RETRIES
                 RECS.       INPUT        SIZE      PERM  ZERO B   SHORT   UNDEF.   #RECS.  TOTAL#
           1       1          1            60         0      0       0        0        0       0
 ******     EOF ON COMPLETION OF DUMP FOR REQUEST SR=1=1=1

    FILE     82  RECORD      1  LENGTH      60BYTES
    (      0)  00000048  0000004F  00000002  0000000E  FFB9E970  0006AAED  0450E2AF  00000001  0000004F  00000006
    (     40)  00000005  00000001  0000004F  00000007  0000000C

          FILE   INPUT    DATA RECORDS    MAX.        READ ERROR SUMMARY              INPUT RETRIES
                 RECS.       INPUT        SIZE      PERM  ZERO B   SHORT   UNDEF.   #RECS.  TOTAL#
          82       1          1            60         0      0       0        0        0       0
 ******     EOF ON COMPLETION OF DUMP FOR REQUEST SR=82=1=1X

   EOJ         DUMP STOPPED AFTER FILE    84        # OF PERMANENT READ ERRORS  0

 START TIME 10/13/81   13:37:39         STOP TIME 10/13/81   13:41:57

 $$
```